Proceedings of the Canadian Society for Mechanical Engineering International Congress 2022
CSME Congress 2022
June 5-8, 2022, Edmonton, AB, Canada

Design for Additive Manufacturing – from pure complexity to multi-functionality

Yaoyao Fiona Zhao
Department of Mechanical Engineering
McGill University
Montreal, QC, Canada
Yaoyao.zhao@mcgill.ca

ABSTRACT

Since Additive Manufacturing (AM) processes can fabricate complex part shapes and material compositions, it released significant amount of freedom for designers to design innovative products. In general, parts that are good candidates for AM tend to have complex geometries, low production volumes, special combinations of properties or characteristics. Most of existing design methods and approaches are well established for conventional manufacturing processes which tend to limit the complexity and potential multi-functionalities of products considerably.

Given the unique characteristics of AM, Prof. Zhao and her team have proposed a new definition for the term -- Design for Additive Manufacturing (also known as DfAM or DFAM) -- as "a general type of design methods or tools whereby functional performance and/or other key product life-cycle considerations such as manufacturability, reliability, and cost can be optimized subjected to the capabilities of additive manufacturing technologies". Most research in DFAM field only focuses on specific topics without considering AM process specific characteristics. AM technology connects design, material properties, process settings, end-product quality, and potential post-process operations intimately. When DFAM is applied, AM process-specific capabilities and constraints must be considered at early design stage.

Thus, rooted from the proposed definition, this talk will report Prof. Zhao and her team's recent work on developing novel design strategies and geometric modeling techniques to support multi-functional design concept generation and multi-scale highly complex CAD model realization with manufacturability analysis applied at early design stage. Additionally, Prof. Zhao will present the research effort from her team on the application of machine learning in design and manufacturing field with discussions on the opportunities and limitations of this research direction.